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1. Document ID: GB 2117889 A GB 2117889 B ,

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December 11, 1998

Entry 1 of 1 File:DERWENT

DERWENT-ACC-NO: 1983-790838

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TITLE:
Atmospheric moisture condensing and collecting equipment - has thermally insulated water conduit and receiver cooled by processed air

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GB 2117889 A	October 19, 1983	N/A	004	N/A
GB 2117889 B	May 30, 1985	N/A	000	N/A

APPLICATION-DATA:

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GB 2117889A	N/A	1982GB-0003467	February 5, 1982

IPC: B01D005/00; F25B039/04

ABSTRACTED-PUB-NO:GB 2117889A
BASIC-ABSTRACT:Appts. includes a thermally insulated water conduit and receiver cooled by the processed air. The refrigeration compressor(s) may be mechanically driven by a wind turbine, optionally via magnetic or electromagnetic couplings. Air cooling may be assisted by heat-exchange between incoming air and outgoing cold dried air, and exchange may be supplemented by an evaporation type refrigerator operated with waste heat from the main refrigerator compressors.

ABSTRACTED-PUB-NO:GB 2117889B
EQUIVALENT-ABSTRACT:Appts. includes a thermally insulated water conduit and receiver cooled by the processed air. The refrigeration compressor(s) may be mechanically driven by a wind turbine, optionally via magnetic or

electromagnetic couplings. Air cooling may be assisted by heat-exchange between incoming air and outgoing cold dried air, and exchange may be supplemented by an evaporation type refrigerator operated with waste heat from the main refrigerator compressors.

CHOSEN-DRAWING:Dwg.0/1 Dwg.0/1

TITLE-TERMS:
ATMOSPHERE MOIST CONDENSATION COLLECT EQUIPMENT THERMAL INSULATE WATER CONDUIT RECEIVE COOLING PROCESS AIR

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(54) Atmospheric water extractor

(57) An atmospheric moisture condensation equipment dimensioned to collect and store water derived from the atmosphere comprising in combination a refrigeration unit 3, an air stream heat exchanger 24, forced air circulation fan 5, thermally lagged and cooled water conduits and water storage receiver 8. The cooling of moist air is supplemented in some installations by an evaporation type refrigeration cycle 10 energised by waste heat from the main refrigerator compressor 6. The motive power for the main refrigerator and forced air circulation may be derived from wind turbines directly, magnetically or electrically coupled to the air processing equipment.

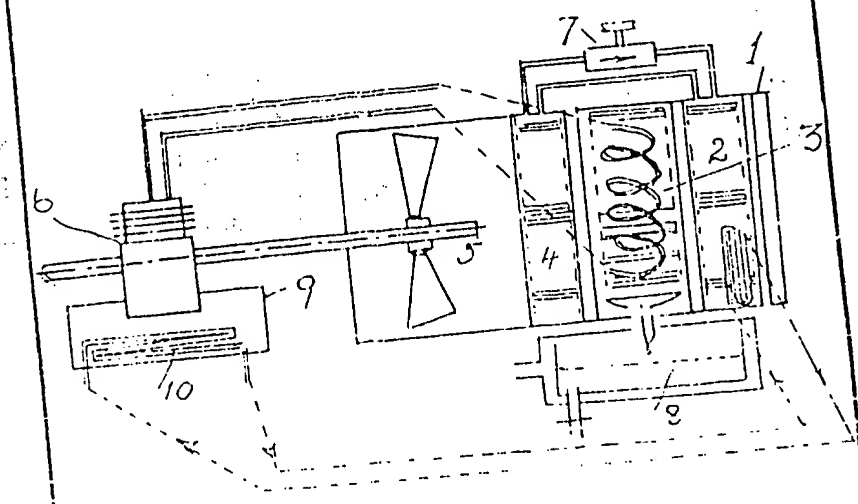

FIG 1

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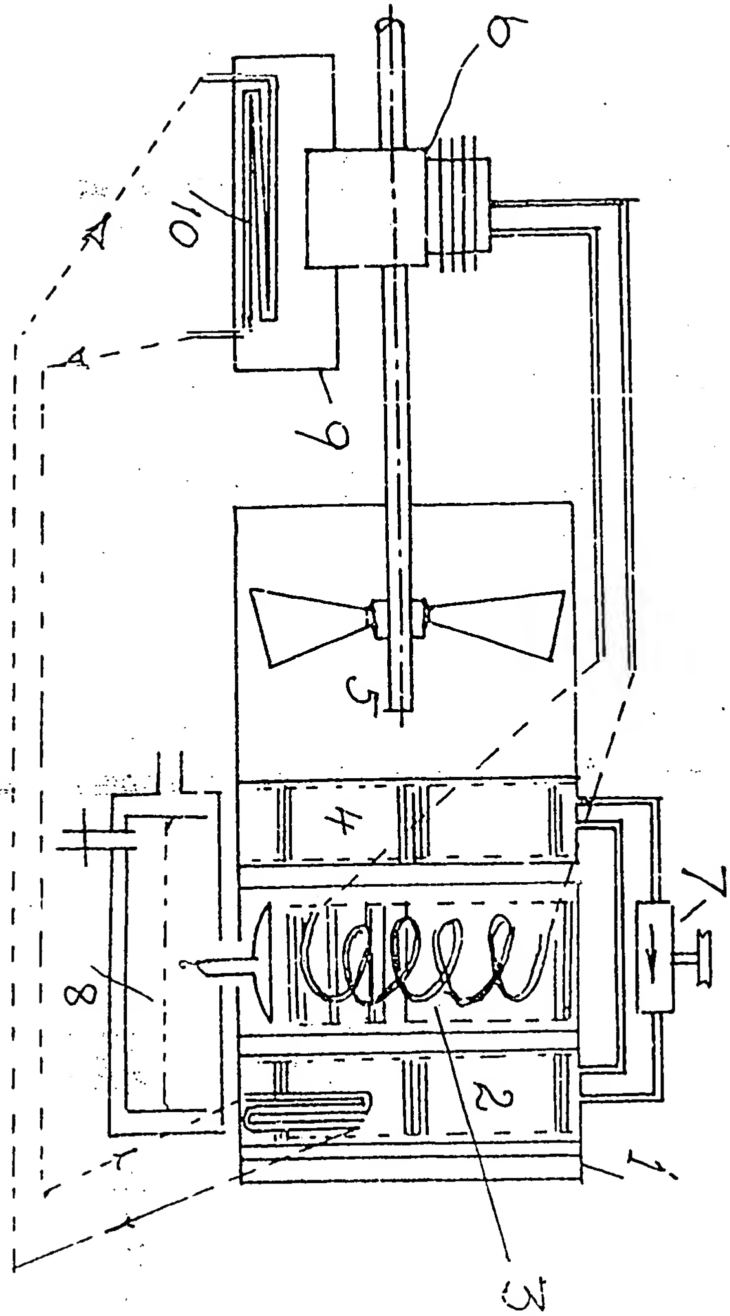

FIG 1

SPECIFICATION

Atmospheric water extractor

This invention has as its main purpose the provision of a supply of potable water by condensation of atmospheric water vapour. Basically the device is a refrigeration type dehumidifier with a water collector and storage facility. It differs from air conditioners and atmospheric heat extractors in combining the cooling arrangements with heat exchangers and in some applications employing waste heat from the compressors to augment the cooling system.

Energy is necessary to operate the refrigerant heat-pump compressor, to circulate cooling fluid in the heat exchangers, to circulate air through the plant, and provide forced air or liquid cooling to the compressor. The power may be provided by electricity, internal combustion engines or directly from wind turbines. If wind power is used and is only available intermittently alternative power may be combined to supplement the action.

The compressor energy input for 20 KW cooling would be approximately 5 KW. Condensation of water vapour releases considerable heat, approximately 10^6 joules per Kg. water condensed.

If 1 M^3 of air at 40°C is processed per second at 50% relative humidity (R.H.) to produce a water output of 100 gallons per day (5 ml/second), as is practicable, then the energy to be extracted from the system is 21 KW, providing the cooled dry air is employed to pre-cool, in a heat exchanger, the incoming moist air to the dew point (95% R.H.) and to assist cooling of the compressor.

The absorbed heat is transferred to the [illegible]s from where, together with the [illegible] motive power, it must be removed by [illegible] air or liquid cooling. The heat to be removed is 26 KW. If the cool dried air is expended for domestic or farm purposes then the total cooling needed is increased by about 50%.

If wind energy is used for the motive power driving the open type compressor directly with chain or belt drive to the air impellers and coolant pumps the size of wind turbine necessary is determined by the experimental knowledge that approximately half the kinetic energy in the wind can be converted to mechanical power.

The kinetic energy $\frac{1}{2}MV^2$, where M is mass of air and V is velocity, becomes $\frac{1}{2}\rho V^3 A$ where A is swept area by turbine and ρ air density 1.2 Kg/m^3.

Talking half of this energy (or for large installations up to 0.593 Betz coefficient) 5 Kw of power could be derived from an area of 23 sq. metres, radius 2.7m. if the wind velocity were 20 M.P.H. (9 metres/second).

The heat energy output from the compressors is some four times greater than the energy input and may be usefully employed domestically or industrially where a need prevails. With most refrigerants the compressor temperature is limited to 50°C or below. This low grade heat output may be stored in a large heat sink and used to operate an evaporation type refrigerator, similar to the domestic types marketed by the gas board, to operate a thermoelectric-Peltier heat transfer grid, so that the compressors could be used on an intermittent basis. Wind power has the disadvantage of intermittency and augmentation through the use of waste heat can make its employment more successful. Waste heat could also serve to operate a thermoelectric low voltage power source.

The heat exchanger for precooling the air to be processed may be of the interleaved corrugated fin type where heat is transferred through thin metallic sheets, or heat may be transferred by a slowly rotating thermal storage wheel, or by liquid cooled motor car type radiators or by an evaporation type refrigerator.

An example of the invention is shown schematically in the attached figureI. Air is drawn through a dust filter (1) the first section of a liquid cooled heat exchanger (2) the main cooling coil (3) the second section of the heat exchanger (4) by the air impeller fan (5). The shaft of the directly driven open type compressor (6) drives the fan (5) also. Coolant between the two parts of the heat exchanger is circulated by the pump (7) chain driven from the compressor shaft. Below the main cooling unit is a water catchment tray funneled to the receiver (8) which is cooled by a fraction of the cold dried air. In this example waste heat from the compressor is absorbed in the heat sink (9) which heats an evaporation type refrigerator pipe circuit (10) and thus provides additional cooling to the first part of the heat exchanger.

To give dimensions to this example: for an air flow of 1/4 m^3/second at 50% R.H. and a temperature of 36°C in the incoming moist air, a 2 horse power motor drive (1.5 Kw) would suffice for the compressor and air impeller and coolant pump. If the face area of the heat exchangers: $\frac{1}{2}$ sq. metre the air pressure difference through the system would be approximately 4 cm water gauge. By the calculations given a wind turbine would need a face area of 7 sq. m. or a rotor radius of 1.3 m.

With intermittent wind power a stored power source, or stored compressed air would be required to promote air flow and coolant circulation while the heat sink store continued cooling operations.

Claims (Filed on 2-2-83)

1. An atmospheric moisture condensing and collecting equipment with thermally insulated water conduit and reciver cooled by the processed air.

2. An equipment as claim 1 in which the cooling of the incoming moist air is aided by a heat exchanger between the incoming air and the outgoing cold dried air.

3. An equipment as claim 2 in which the refrigerator compressor(s) are mechanically driven by a wind turbine.

4. An equipment as claim 2 in which the refrigerator compressor(s) are mechanically driven by a wind turbine through a magnetic coupling.

5. An equipment as claim 2 in which the refrigerator compressor(s) are electro-mechanically coupled to a wind turbine.

6. An equipment as claim 2 in which the heat exchanger action is supplemented by an evaporation type refrigerator operated with waste heat from the main refrigerator compressors or compressor.

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